

ANGLE MEASURING SYSTEM WITH A CLAMPABLE SHAFT

FIELD OF THE INVENTION

The present invention relates to an angle measuring system with a coding disk for measuring the angular position of a pick-up shaft having a clamping device for clamping the pick-up shaft, fixed against relative rotation, to a driveshaft of a drive unit. The pick-up shaft has axial slits in the clamping area and can be radially spread open by an actuating element.

BACKGROUND OF THE INVENTION

U.S. Pat. No. 4,652,748 discloses an angle step indicator. It consists of a housing in which a hollow shaft is rotatably seated. A coding disk for measuring the angular position of the shaft with respect to a scanning unit fastened to the housing is fastened on this shaft, fixed against relative rotation. One end of the shaft is slitted and has a conical interior bore on which the conical tip of a pin acts. The pin is axially displaceable by a screw inserted into the other end of the shaft so that the slitted end of the shaft is spread open. The shaft of the angle measuring system is radially clamped by this spreading open of the slitted end of the shaft in either a bore of an element of a shaft coupling or directly in a bore of a motor shaft. In every case the shaft of the angle measuring device is connected with the driveshaft, for example a motor shaft, by a shaft coupling.

A similar angle measuring device is described in German Patent Publication No. DE 30 38 005 A1. In this example the shaft end facing the drive unit is also slitted. This shaft end can be spread open by a wedge. The wedge has an interior thread which works together with the exterior thread of a screw. The head of the screw is supported on the shaft end, so that the screw itself is not axially displaceable. The thread flanks of the screw are displaced in the axial direction by turning the screw, which causes an axial displacement of the wedge and thus radial spreading of the slitted shaft end.

All known measuring systems have the disadvantage that, in addition to the screw, other elements, are still required for spreading.

It is thus desirable to provide an angle measuring system with a clampable shaft with relatively fewer elements than known systems and which is simple to implement.

SUMMARY OF THE INVENTION

According to a first aspect of the present invention there is provided an angle measuring system having a coding disk for measuring the angular position of a pick-up shaft and a clamping device for clamping the pick-up shaft, fixed against relative rotation, to a driveshaft of a drive unit. The pick-up shaft has axial slits in the clamping area which can be radially spread open by an actuating element. The system includes a screw being the actuating element which can be turned in the pick-up shaft and which has an exterior thread in the clamping area, and a corresponding interior thread on the pick-up shaft in the clamping area. The screw has an axially acting detent surface which is supported against an axial detent of the pick-up shaft during clamping.

It is an object of the invention to disclose an angle measuring system which is simply constructed and which makes possible a dependable and simple clamping of the shaft with a driveshaft.

The invention will be explained in more detail with reference to the Figures and detailed description of the presently preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a cross-sectional view of an angle measuring system according to a preferred embodiment of the present invention.

FIG. 2 illustrates an exploded view of a portion of the measuring system shown in FIG. 1 which illustrates the principle of operation of the shaft clamping according to a preferred embodiment of the present invention.

FIG. 3 is a vector representation of the forces shown in FIG. 2.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

The angle measuring system shown in FIG. 1 includes a stator 1, a pick-up shaft 2, a coding disk 3, a scanning unit 4, a coupling 5, and a stationary element 6 of a drive unit, for example, a motor. The pick-up shaft 2 is preferably continuously hollow and is rotatably seated in the stator 1. The coding disk 3 is fastened to a first end of the pick-up shaft 2 by glue, for example. In a preferred embodiment an incremental or absolute coding is placed on the coding disk 3. The coding disk 3 is scanned by the scanning unit 4 which emits position-dependent electrical signals as is well known to those of ordinary skill in the art and thus need not be described in detail herein.

The stator 1 is fastened by coupling 5 to the stationary element 6. The coupling 5 assures a connection, fixed against relative rotation, of the stator 1 and the stationary element 6, but permits compensating movements between these two elements in all directions. The coupling 5 is especially rigid and free of play in the direction of rotation. In a preferred embodiment the coupling 5 consists of a spring sheet metal plate with several leaf spring arms 51 and 52. Each leaf spring arm 51, 52 has axially extending areas 53, 54, which are substantially parallel with the pick-up shaft 2 and radial areas 55, 56 extending perpendicularly to the pick-up shaft 2. The axially extending areas 53, 54 form a spring parallelogram and permit radial compensation movements between the stator 1 and the stationary element 6 which occur, inevitably because of eccentricities between the stator 1 and the stationary element 6. The radially extending areas 55, 56 permit axial compensation movements between the stator 1 and the stationary element 6. Such a coupling has been described, for example, in German Patent Publication No. DE 89 15 109 U1.

The second end of the pick-up shaft 2 which is opposite of the first end on which the coding disk 3 is coupled and which faces the stationary element 6 has axially extending slits 7 and an interior thread 8. If the pick-up shaft 2 is to be connected, fixed against relative rotation, with a driveshaft 9 located in the stationary element 6, the slitted second end of the pick-up shaft 2 is pushed into a bore 10 located in the driveshaft 9 and the slitted area of the pick-up shaft is spread open radially which achieves a rigid radial clamping. A screw 11 is used to spread the slitted area of the pick-up shaft open. More particularly, the screw 11 has an exterior thread 12 on one end and a head 13 on an opposite end. Starting at the first end of the pick-up shaft 2, the screw 11 is turned into the hollow pick-up shaft 2 until the screw's radially extending surface 14 is supported at a shoulder having a radially extending surface 15 of the pick-up shaft 2. The surfaces 14 and 15 form an axially effective detent up to which the screw 11 can be turned into the pick-up shaft 2.

If, after reaching the shoulder of the pick-up shaft 2, the screw 11 is further turned with relation to the pick-up shaft